Remarks / Arguments

Claims 1-9 and 17 are pending. Claims 12, 14, 15 and 16 have been canceled without prejudice or disclaimer of any previously claimed subject matter. Applicants reserve the right to present any withdrawn or canceled subject matter in one or more continuation or divisional applications.

Applicants thank the Examiner for the indication that claims 8 and 9 are allowable.

Applicants note that the section "Legend to Figure 1", on page 20, lines 17-20 will be included in the formal drawing of Figure 1, upon submission of formal drawings. The Examiner has requested that formal drawings be submitted upon allowance.

Rejections under 35 U.S.C. § 112

The Examiner has rejected claims 1-9 and 17 under 35 U.S.C. §112, second paragraph, as indefinite. Specifically, the Examiner has objected to claim 1 for not specifying whether B is a protected or unprotected base, and if protected, what the protecting group can be. To comply with the Examiner's request, claim 1 has been amended to recite that B' is a purine or pyrimidine base B which is optionally protected by a protecting group selected from the group consisting of an acyl, a benzoyl, a benzyl or a silyl group. Support for this amendment is found in the specification on page 3, lines 27-28.

The Examiner has asserted that "it is very well known in the nucleoside synthesis art that unprotected bases are not preferred and that protection is essential to achieve reasonable yields." Based on this comment, the Examiner alleges that the instant process is incomplete for failure to define the different process conditions required depending on whether protection is present or absent. Applicants respectfully disagree with the Examiner's statement that protection of the bases is essential. Example 2, on page 11 of the specification provides a preparation of 1-(2-*o*-acetyl-3,5-di-*o*-benzoyl-β-L-xylofuranosyl)uracil, in which a glycosidic condensation occurs. This preparation is known as a Vorbruggen procedure and is typically used to to effect glycosylations in which the base is thymine or uracil, (see for example, Perigaud et al. J. Chem. Soc. Perkin Trans. 1, 1992, pp. 1943-1952, copy enclosed as Attachment A). As cited in Example 2, the general conditions and instrumentation used for this preparation are identical to that of Perigaud et al. Applicants note that in Perigaud et al. on page 1944, the authors state that

"glycosylation were effected by various procedures which except for the guanine and cytosine series, did not require prior protection of the heterocyclic bases (Scheme 2). Hence, the method of Saneyoshi et al.[25] was successful with adenine, while the nucleosides of thymine and uracil were obtained by Vorbruggen procedures.[26]" (emphasis added). Thus, Perigaud et al. report that for adenine, thymine and uracil protection of the bases prior to the glycosylation, or condensation, step is not necessary to obtain yields of 68-74% (see pages 19467-47).

Perigaud et al. clarifies that protection of a base during these reactions depends on the nature of the base, and that the bases requiring protection and the nature of the protection are well-established in the art. Therefore, Applicants respectfully request to retain in claim 1 "B' is a purine or pyrimidine base B which is optionally protected". Applicants respectfully request withdrawal of this rejection.

The Examiner has objected to the use of the functional language "condensed". The term "condensed" is recited in step 1 of claim 1. As noted in the schematic embedded in claim 1, during step 1, B' replaces the X group on compound of formula II. This step is written out as "a compound of formula (II) is condensed with the base B'". The term "condensed" would be understood by one of skill in the art of preparing nucleosides. As described above, the specific conditions and reactants used in the condensation step will vary depending on the base, however such conditions are well known to one of skill in the art and are referenced in the specification (see Example 2 on page 11, and Perigaud et al.). It is submitted that the use of the term "condensed" in conjunction with the depiction of the reaction wherein a compound of formula (II) is condensed with the base B' is a clear representation of the key feature of step 1 of claim 1. Applicants respectfully request withdrawal of this rejection.

The Examiner has objected to the term "appropriate" in claim 1. Applicants have amended claim 1 to remove the term "appropriate", rendering this objection moot.

The Examiner has objected to the preamble of claim 1 as rendering the claim incomplete. Specifically, the Examiner alleges that claim 1 describes a process for making three different compounds, but only discloses the deprotection of the 2'-hydroxyl and removal of same by a deoxygenation process. The Examiner requests that the preamble of claim 1 be amended to

introduce the additional enabled process steps necessary to permit the other two classes of compounds to be synthesized.

Applicants believe the Examiner has misunderstood the claim. It is submitted that process of claim 1 supports the synthesis of 2'-deoxy, 3'-deoxy and 2',3'-dideoxysugars. Applicants note that R_1 is OH, however R_2 and R_3 can be either H or OH. R'_1 and R'_2 have the same definitions as R_1 and R_2, however R'_3 is C_1 to C_5 alkyl group or a phenyl radical, which is attached to the sugar moiety via a -C(O)O- group. To produce the 2'-deoxy sugar, R_2/R'_2 is OH, and, in step 2, the R'_3COO group at the 2' position is removed by deacetylation so as to obtain an OH group. In step 3, the OH group at the 2' position is removed by a deoxygenation reaction to produce the 2'-deoxy sugar. To produce the 3'-deoxy sugar, R_2/R'_2 is H, and, in step 2, the R'_3COO group at the 2' position is removed by deacetylation so as to obtain an OH group. To produce the 2',3'-dideoxy sugar, R_2/R'_2 is H, and, in step 2, the R'_3COO group at the 2' position is removed by deacetylation so as to obtain an OH group. In step 3, the OH group at the 2' position is removed by a deoxygenation reaction to produce the 2',3'-dideoxy sugar. These steps are also depicted in Figure 1. Compounds 5, 16 and 10 are examples of each of the three classes of compounds produced by the process of claim 1. Thus, all three compound classes are provided for by the process as currently recited in claim 1. Withdrawal of this rejection is respectfully requested.

The Examiner has rejected claim 7, lines 1-5 as (i) lacking antecedent basis in that claim 1 does not provide for the conversion of uracil to cytosine, and (ii) reciting steps which have not been defined thereby rendering the claim incomplete. To address the lack of antecedent basis, Applicants have amended claim 1 to recite the bases which B made be selected from. Support for this amendment is found in the specification on page 4. To address the Examiner's rejection regarding defining the steps of the process, Claim 7 has been amended to recite the steps of the process of converting uridine to cytidine. Support for this amendment is found in the specification in Example 5 on page 17 and in Figure 2. It is submitted the amendments to claim 7 overcome this rejection.

The Examiner has rejected claim 1, 2, 4-6 and 17 for the use of the term "characterized in that". Claim 1 has been amended to replace this term with "comprising", as requested by the Examiner. Claims 2, 4-6 and 17 have been amended to replace this term with "wherein". Withdrawal of this rejection is respectfully requested.

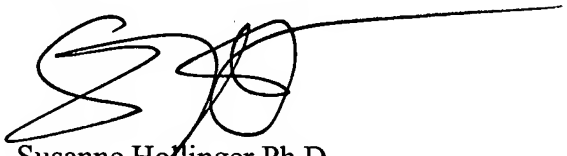
The Examiner has rejected claim 1 for use of the term "such as". Claim 1 has been amended to replace this term with "selected from". Withdrawal of this rejection is respectfully requested.

The Examiner has objected to claim 6-9 for use of the names of the compounds rather that the corresponding substituent groups. Claim 6-9 have been amended to recite the corresponding substituent groups. Withdrawal of this rejection is respectfully requested. Amendments to the specification to conform the language of the specification to that of the claims will be submitted upon indication of allowable claims.

Conclusion

Withdrawal of the outstanding rejections is respectfully requested. Should the Examiner determine that any additional fees are due, the Commissioner is authorized to charge any additional fees to Deposit Account 11-0980.

Respectfully submitted,



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ATTACHMENT A

Potential Antiviral Agents. Stereospecific Synthesis of Purines and Pyrimidines Substituted with Chiral Acyclic Chains by Sugar-Ring Opening of α-L-Arabinopyranosyl Nucleosides

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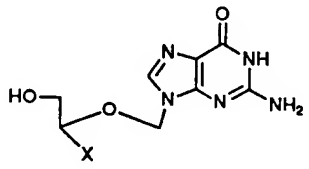
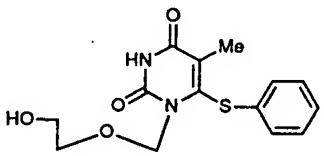
3',4'-Seco-nucleosides as well as their derivatives lacking C-3', all retain the carbon framework and chirality of the β-D-ribofuranosyl moiety of the nucleosides occurring in nucleic acids, have been synthesized and their antiviral properties examined. Most of these chiral acyclic nucleosides were hitherto unknown and they were stereospecifically prepared by ring opening of α-L-arabinopyranosyl nucleosides by means of periodate oxidation followed by borohydride reduction. All the prepared compounds were tested for their activity against a variety of RNA and DNA viruses, but they did not show significant antiviral activity.

Today, several acyclic nucleoside analogues[1] are known potent antiviral agents. Among them, 9-[2-(hydroxyethoxy)methyl]-guanine (Acyclovir)[2] and 9-[(1,3-dihydroxypropan-2-yloxy)-methyl]guanine (DHPG)[3] (Fig. 1) have been approved for clinical use against herpes simplex virus type 1 and human cytomegalovirus infections, respectively. More recently, it was also reported that various 6-substituted acyclic pyrimidine nucleosides related to acyclovir, such as 1-[(2-hydroxyethoxy)-methyl]-6-(phenylthio)thymine (HEPT) (Fig. 1), are selective inhibitors of human immunodeficiency virus in various human lymphocytes.[4]



Acyclovir (X = H)
DHPG (X = CH_2OH)



HEPT

Fig. 1

Since the acyclic nucleosides have the potential for chemotherapeutic activity a large number of compounds of this class have been synthesized. Among them are the 1',2'-[5] and 2',3'-seco-nucleosides[6] which retain the carbon framework and chirality of the β-D-ribofuranosyl moiety of the natural nucleosides at their two asymmetrical carbon atoms (Fig. 2). On the other hand, little attention has been given to either 3',4'-seco-nucleosides or to β-D-ribofuranosyl nucleosides lacking C-3' (Fig. 2). Russian authors envisaged the possibility of preparing 1-[(1*R*,2*R*)-2,3-dihydroxy-1-(2-hydroxyethoxy)propyl]uracil (3',4'-seco-uridine) by periodate oxidation of 1-(α-L-arabino-pyranosyl)uracil, followed by reduction with sodium borohydride.[7] However, no full paper concerning this possibility has been published and only the preparation of achiral 3',4'-seco-nucleosides by condensation of silylated bases with 1,4,5,6-tetraacetoxy-3-oxahexane in the presence of Lewis acids, followed by deacylation, has been reported.[8] Regarding nucleosides lacking C-3', racemic acyclic compounds of the five bases occurring in nucleic acids have been prepared previously following different procedures,[9–12] but only the pure enantiomers having adenine[14] or uracil[12] as aglycone have been reported, and were prepared by ring opening of appropriate pentopyranonucleosides.

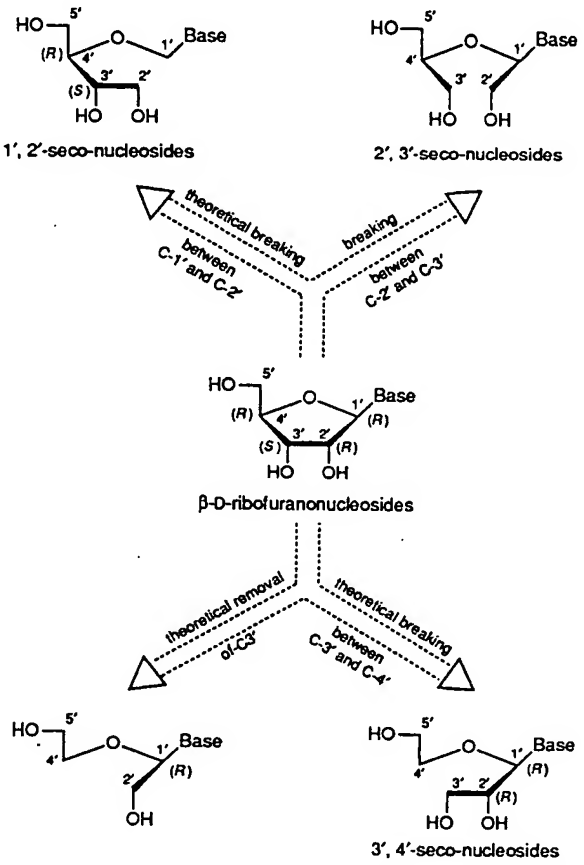


Fig. 2 For convenience, we adopted a 'ribose-like' numbering of the acyclic nucleosides

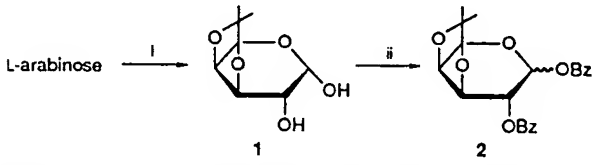
In continuation of our research programme on sugar-

modified nucleoside analogues as potential antiviral agents,[15-23] we now describe the stereospecific synthesis and biological evaluation of open-ring β-D-ribofuranonucleoside derivatives lacking the C-3′–C-4′ bond or the C-3′ atom.

Results and Discussion

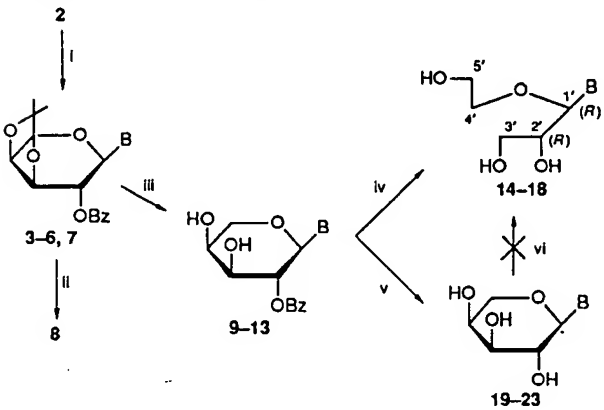
The synthetic route chosen to the chiral acyclic nucleosides consisted of periodate oxidation of a preformed pyranonucleoside and reduction of the resulting dialdehyde with sodium borohydride. Among the various starting materials which could be used, we opted for the α-L-arabinopyranosyl nucleosides, as these compounds: (i) possess the requisite *R* configuration at the 1′- and 2′-carbon, (ii) are not well documented, and (iii) the evaluation of their biological properties seemed to us to be of interest.

Condensation of a suitably protected L-arabinopyranose and the purine or pyrimidine bases was employed to prepare the α-L-arabinopyranosyl nucleosides. In accord with Baker's rule[24] and owing to 2-*O*-acyl participation during the condensation, a 2-*O*-benzoyl-L-arabinopyranose was used for exclusive formation of the α (*trans*-1′,2′) anomers in the arabinose series. As starting sugar we selected the syrupy 1,2-di-*O*-benzoyl-3,4-*O*-isopropylidene-L-arabinopyranose **2**, hitherto unknown and readily prepared from inexpensive, commercial L-arabinose in two steps (Scheme 1).



Scheme 1 *Reagents:* i, $(MeO)_2CMe_2$, PTSA, DMF; ii, BzCl, pyridine

Glycosylations were effected by various procedures which, except for the guanine and cytosine series, did not require prior protection of the heterocyclic bases (Scheme 2). Hence, the



Compound	B = Base
3, 9, 14, 19, 24	adenin-9-yl
4, 10	2-*N*-palmitoylguanin-9-yl
15, 20, 25	guanin-9-yl
5, 11, 16, 21, 26	thymin-1-yl
6, 12, 17, 22, 27	uracil-1-yl
7	4-*N*-benzoycytosin-1-yl
8, 13, 18, 23, 28	cytosin-1-yl

Scheme 2 *Reagents and conditions:* i, Adenine, $SnCl_4$, MeCN for **3**; 2-*N*-palmitoylguanine, BSA, TMSTf, MeCN for **4**; thymine or uracil, HMDS, TMSCl, $SnCl_4$, MeCN for **5** or **6**; silylated 4-*N*-benzoylcytosine, TMSTf, $ClCH_2CH_2Cl$ for **7**; ii, $NH_2NH_2{\cdot}H_2O$, AcOH, C_5H_5N; iii, aq. AcOH; iv, $NaIO_4$; then $NaBH_4$, aq. 1,4-dioxane; then NH_3, MeOH; v, NH_3, MeOH; vi, $NaIO_4$; then $NaBH_4$, aq. 1,4-dioxane

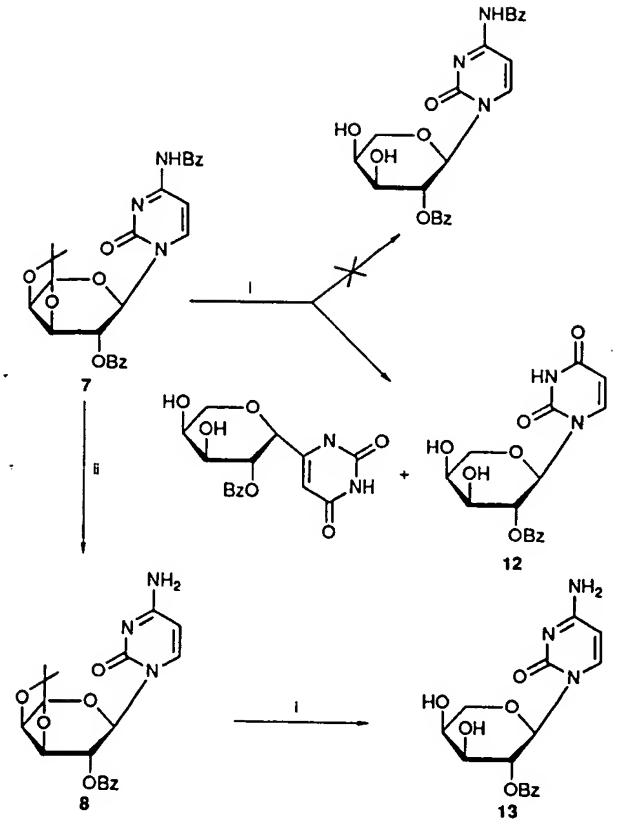
method of Saneyoshi *et al.*[25] was successful with adenine, while the nucleosides of thymine and uracil were obtained by Vorbruggen procedures.[26] Only the expected α-L-9-N **3** isomer (in the case of adenine) and α-L-1-N **5,6** isomers (in the case of thymine and uracil, respectively) were obtained after purification by silica gel column chromatography or direct crystallization. In the guanine series, application of the procedure of Wright and Dudycz[27] to 2-*N*-palmitoylguanine[28] afforded a separable mixture of the expected α-L-9-N **4** and undesirable α-L-7-N isomers. Contrary to all expectations, attempts to prepare 1-(2-*O*-benzoyl-3,4-*O*-isopropylidene-α-L-arabinopyranosyl)cytosine **8** by condensation of the sugar **2** with cytosine following the procedures usually implemented in the pentofuranosyl series[15,16,23,26] were unsuccessful. That is why we first protected the exocyclic amine function of cytosine with a benzoyl group. After silylation, 4-*N*-benzoylcytosine[29] was treated with compound **2** in 1,2-dichloroethane in the presence of trimethylsilyl triflate (TMSTf) to afford the fully protected nucleoside **7** in 67% yield.

Removal of the *O*-isopropylidene protecting group from compounds **3–6** with aqueous acetic acid afforded the desired 2′-*O*-benzoyl-α-L-arabinopyranosyl nucleosides **9–12**. On the other hand, when 4-*N*-benzoyl-1-(2-*O*-benzoyl-3,4-*O*-isopropylidene-α-L-arabinopyranosyl)cytosine **7** was treated with aqueous acetic acid the expected product, 4-*N*-benzoyl-1-(2-*O*-benzoyl-α-L-arabinopyranosyl)cytosine, could not be obtained. Two new compounds were observed on TLC and were isolated by silica gel column chromatography. From their physical properties (data not shown) they were characterized as being the α and β anomers of 1-(2-*O*-benzoyl-L-arabinopyranosyl)uracil (Scheme 3). These reactions of deamination[30] and partial anomerization are peculiar to the 4-*N*-benzoylcytosine derivative **7** since under the same acidic conditions the cytosine derivatives **8** and **13** were not deaminated and uracils **6** and **12** did not anomerize.

Selective 4-*N*-deacylation of nucleoside **7** could be effected by the procedure of Letsinger *et al.*[31] with hydrazine hydrate in a buffered acetic acid–pyridine mixture to give compound **8**, which was subsequently de-*O*-isopropylidenated to afford compound **13** (Scheme 3).

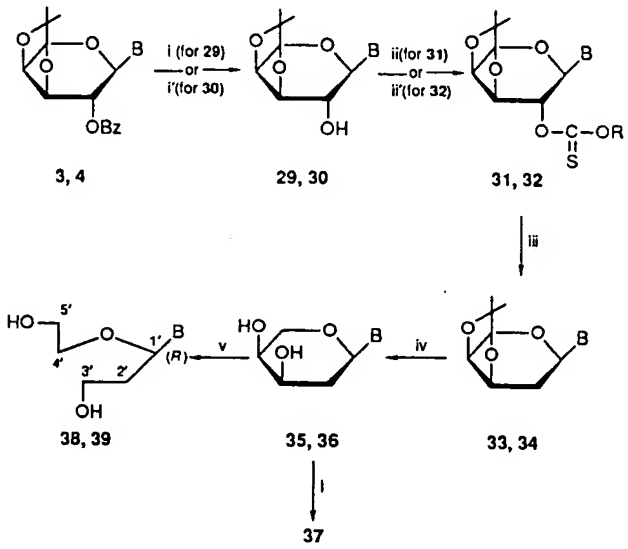
The 2′-*O*-benzoyl-α-L-arabinopyranosyl nucleosides **9–13** are the key intermediates in our synthetic approach (Scheme 2). On the one hand scission of their 3′,4′-bond by periodate oxidation,[32,33] followed first by sodium borohydride reduction of the formed dialdehydes and then by deacylation with ammonia in methanol, resulted in the formation of the hitherto unknown chiral (1′*R*,2′*R*) 3′,4′-seco analogues **14–18** of the natural β-D-ribofuranosyl nucleosides. On the other hand, deacylation of compounds **9–13** in methanolic ammonia yielded the unprotected α-L-arabinopyranosyl nucleosides **19–32** in good yield. When these nucleosides **19–23** were treated with two mole equivalents of sodium metaperiodate and then with sodium borohydride, successive scissions of the 3′,4′ and 2′,3′ bonds followed by reduction of the intermediary dialdehydes resulted in the formation of the expected chiral β-D-ribofuranosyl nucleoside derivatives lacking C-3′, diols **24–28**. Among them, only those bearing adenine, **24**,[14] or uracil, **27**,[12] have been reported previously but in the latter case no physical properties were described.

It is noteworthy that we also studied the possibility of preparing the 3′,4′-seco nucleosides **14–18** directly from the unprotected compounds **19–23** by using only one mole equivalent of sodium metaperiodate. This possibility, which has been expressed in the literature,[7] implies that the periodate cleavage of the 2′,3′ α-hydroxy carbonyl function generated by scission of the 3′,4′-bond occurs more slowly than does the 3′,4′-bond scission. However, all attempts were unsuccessful and we could detect by TLC only the acyclic nucleosides **24–28** lacking C-3′ and the remaining starting compounds **19–23**.



Scheme 3 *Reagents and conditions:* i, aq. AcOH; ii, $NH_2NH_2{\cdot}H_2O$, AcOH, C_5H_5N

Finally, it seemed worthwhile to synthesize the chiral 9-[(1*R*)-3-hydroxy-1-(2-hydroxyethoxy)propyl]-adenine **38** and -guanine **39** for which only racemic mixtures had been described previous to our starting this work,[9,34,35] and for which the synthesis has been mentioned very recently.[36,37] Therefore (Scheme 4), selective 2′-*O*-debenzoylation of protected nucleosides **3**,**4** by methanolic ammonia or aqueous sodium hydroxide in a pyridine–ethanol mixture, respectively, gave the 3′,4′-*O*-isopropylidene derivatives **29** and **30**. Barton-type deoxygenative hydrogenolysis of thionocarbonate esters[38] was chosen for the preparation of the 2′-deoxy-α-L-arabinopyranosyl nucleosides. In the guanine series, reaction of compound **30** with *O*-phenyl chlorothiocarbonate and 4-(dimethylamino)pyridine (DMAP) in acetonitrile[17,39] gave the corresponding 2′-*O*-[phenoxy(thiocarbonyl)] derivative **32**, which was treated with tributyltin hydride and the free-radical initiator α,α′-azoisobutyronitrile (AIBN) in toluene to afford, after purification by column chromatography, the protected 2′-deoxygenated product **34**. In the adenine series, treatment of compound **29** with excess of *N*,*N*′-thiocarbonyldiimidazole in dimethylformamide (DMF) gave an intermediate imidazolide which, upon reaction with anhydrous methanol at 60 °C for 2 h,[40] yielded the crystalline methyl thiocarbonate **31** in 58% yield. Reduction of thioester **31** with tributyltin hydride in toluene containing AIBN afforded crystalline compound **33** after column chromatography. The hitherto unknown 9-(2-deoxy-α-L-*erythro*-pentopyranosyl)-adenine **35** and -guanine **37** were obtained by deisopropylidenation of compounds **33** and **34** under acidic conditions, followed in the latter case by *N*-deacylation of the intermediate **36** with methanolic ammonia. Scission of the 3′,4′-bond of intermediates **35** and **36** by periodate oxidation, followed by sodium borohydride reduction, resulted in the formation of the chiral (1′*R*)-3′,4′-seco derivatives **38**,**39** of the natural β-D-2′-deoxyribofuranosyl nucleosides, which were obtained pure after silanized silical gel column chromatography. The physical data for these acyclic nucleosides **38**,**39** were more or less in accord with literature data for their racemates[9,34,35] and for the *R* enantiomers reported during the course of this work.[36,37]



Compound	B = Base
3, **29**, **31** (R = Me), **33**, **35**, **38**	adenin-9-yl
4, **30**, **32** (R = Ph), **34**, **36**	2-*N*-palmitoylguanin-9-yl
37, **39**	guanin-9-yl

Scheme 4 *Reagents and conditions:* i, NH_3, MeOH; i′, NaOH, C_5H_5N–EtOH; ii, $(Im)_2CS$, DMF; then MeOH; ii′, DMAP, PhOCSCl, MeCN; iii, Bu_3ShH, AIBN, toluene; iv, aq. AcOH; v, $NaIO_4$; then $NaBH_4$, aq. 1,4-dioxane (followed by NH_3, MeOH in the case of compound **36**)

Biological Evaluation

All the prepared α-L-pentopyranosyl nucleosides **19**–**23**, **35**, **36** and chiral acyclic nucleosides **14**–**18**, **24**–**28**, **38**, **39** were tested for their *in vitro* inhibitory effects on the replication of a number of DNA viruses (*i.e.*, human cytomegalovirus, herpes simplex virus type 1 and type 2, vaccinia virus) and RNA viruses (parainfluenza virus type III, respiratory syncytial virus, Sindbis virus, Coxsackie virus B3 and polio virus-1) in three cell systems (MRC-5, Vero and KB cells). None of these compounds showed marked antiviral effects or detectable alteration of host cell morphology at the highest concentration tested (generally 1 mmol dm^{-3}). When evaluated in two anti-human immunodeficiency virus (anti-HIV) assays, none of the tested compounds showed marked antiviral effect at a concentration less than 10-fold lower than the minimal concentration causing a detectable alteration of MT-4 and CEM host cell viability (≈ 1 mmol dm^{-3}). Furthermore, two compounds, namely 9-(2-deoxy-α-L-*erythro*-pentopyranosyl)guanine **37** and 9-[(1*R*)-3-hydroxy-1-(2-hydroxyethoxy)propyl]guanine **39**, were significantly cytotoxic against MT-4 cells ($100 > CD_{50} > 10$ μmol dm^{-3} and $10 > CD_{50} > 1$ μmol dm^{-3}, respectively).

Conclusions.—From the present work, it is obvious that an α-L-pentopyranose structure or the lack of the 3′,4′-bond or C-3′ atom in nucleosides does not induce inhibition of virus multiplication. Among the several hypotheses that can explain this lack of activity, the inability of these compounds to enter cells, to serve as substrate for the intracellular enzymes catalysing triphosphorylation or to inhibit enzymes involved in the metabolism of nucleic acids can be proposed. Further research

is needed to test these hypotheses, but the present data obtained with substrates **15**, **25** and **39** show that introduction of an additional chain on the C-1′ atom of acyclovir leads to loss of antiviral activity.

Experimental

Evaporation of solvents was done with rotary evaporator under reduced pressure. M.p.s were determined in open capillary tubes on a Gallenkamp MFB-595-010 M apparatus and are uncorrected. UV spectra were recorded on an Uvikon 810 (KONTRON) spectrophotometer. ^{1}H NMR spectra were run at ambient temperature in $(CD_3)_2SO$ with a Bruker WM 360 WB spectrometer. Chemical shifts are given in δ-values $(CD_3)(CD_2H)SO$ being set at δ_H 2.49 as a reference. Deuterium exchange and decoupling experiments were performed in order to confirm proton assignments. All *J*-values are in Hz. FAB mass spectra were recorded in the positive-ion or negative-ion mode on a JEOL DX 300 mass spectrometer operating with a JMA-DA 5000 mass data system. Xe atoms were used for the gun at 3 kV with a total discharge current of 20 mA. The matrix was glycerol (G), a mixture (50:50, v/v) of glycerol and thioglycerol (G–T) or 3-nitrobenzyl alcohol (NBA). Specific rotations were measured on a Perkin-Elmer Model 241 spectropolarimeter (path length 1 cm), and are given in units of 10^{-1} deg cm^2 g^{-1}. Elemental analyses were carried out by the Service de Microanalyses du CNRS, Division de Vernaison (France). TLC was performed on precoated aluminium sheets of Silica Gel 60 F_{254} (Merck, Art. 5554), visualization of products being accomplished by UV absorbance followed by charring with 10% ethanolic sulfuric acid and heating. Column chromatography was carried out on Silica Gel 60 (Merck, Art. 9385) or on Silanized Silica Gel RP2 (Merck, Art. 7719) at atmospheric pressure. High-performance liquid chromatographic (HPLC) purifications were carried out on a Waters Associates Unit equipped with two Model 6000 A solvent delivery systems, a Model 680 solvent programmer, a Model U6K sample injector, a Waters 990 photodiode array detector, and a NEC-APC IV microprocessor-controlled data system. The column was a Waters C_{18} 'Radial Pak' (100 × 8 mm id, 10 μm particle size), inserted into a Waters Associates Radial Compression module RCM 100 and protected by a prefilter and a precolumn C_{18} 'Guard Pak'. Light petroleum refers to the fraction boiling in the range 40–60 °C.

3,4-O-*Isopropylidene*-β-L-*arabinopyranose* **1**.—This compound was prepared as described[41] for the D-enantiomer by treatment of L-arabinose (8.00 g, 53.3 mmol) with 2,2-dimethoxypropane (20 cm^3, 163 mmol) in dry DMF (100 cm^3) in the presence of toluene-4-sulfonic acid (PTSA) (0.12 g, 0.63 mmol). Column chromatography of the product on silica gel using a stepwise gradient of methanol (0–10%) in dichloromethane afforded the title compound **1** (8.4 g, 83%), which was crystallized from light petroleum, m.p. 84–85 °C (lit.,[42] 80 °C; lit.,[43] 78–80 °C and 80–81 °C) (for the D-enantiomer: lit.,[41] 84–85 °C; lit.,[44] 78 °C; lit.[45] 82–85 °C; lit.,[46] 82–84 °C); $[\alpha]_D^{20}$ +111.0 (*c* 1.0, water) {lit.,[42] $[\alpha]_D^{20}$ +128.8 (*c* 0.93, water)} {for the D-enantiomer: lit.,[41] $[\alpha]_D^{20}$ −111.1 (*c* 0.5, water); lit.,[44] −111 (*c* 1.1, water); lit.,[46] $[\alpha]_D^{20}$ from −156 to −111 (*c* 1.1, water)}; ^{1}H NMR data $(CD_3)_2SO$ were in accord with literature data.[43,46]

1,2-*Di*-O-*benzoyl*-3,4-O-*isopropylidene*-L-*arabinopyranose* **2**.—A solution of 3,4-*O*-isopropylidene-β-L-arabinopyranose **1** (1.90 g, 10 mmol) in anhydrous pyridine (10 cm^3) was cooled in an ice-bath, and benzoyl chloride (3.49 cm^3, 30 mmol) was added dropwise to the stirred mixture. The reaction mixture was stirred at room temperature overnight with exclusion of moisture. A mixture of water and ice (~30 cm^3) was added, and the mixture was stirred for 1 h. The products were extracted into dichloromethane (3 × 10 cm^3). The combined organic layers were washed successively with ice-cold 3 mol dm^{-3} aq. sulfuric acid (3 × 50 cm^3), water (3 × 50 cm^3), saturated aq. sodium hydrogen carbonate, and water, then dried over sodium sulfate, filtered, and evaporated to dryness under reduced pressure. The resulting syrup consisted of an anomeric mixture of the *title compound* **2** (3.39 g, 85%; ratio β/α ~2:1 as determined from its ^{1}H NMR spectrum) and was sufficiently pure to be directly used in the condensation steps; δ_H 8.0–7.5 (10 H total sum, 3 m, 2 × Ph for α- and β-anomer), 6.41 and 5.99 [1 H total sum, 2 d, $J_{1,2}$ 3.4, 1-H β-anomer and $J_{1,2}$ 7.6, 1-H α-anomer, respectively], 5.37 and 5.27 [1 H total sum, t and dd, *J* 7.5, 2-H α-anomer and $J_{1,2}$ 3.4, $J_{2,3}$ 7.6, 2-H β-anomer, respectively], 4.71 (dd, $J_{2,3}$ 7.5, $J_{3,4}$ 5.7, 3-H β-anomer), 4.56 (1 H, total sum, m, 3-H α-anomer and 4-H β-anomer), 4.41 (m, 5-H β-anomer), 4.2–4.1 (m, 4-H, 5-H, 5′-H α-anomer and 5′-H β-anomer), 1.52 and 1.32 (2 s, CMe_2 α-anomer), 1.50 and 1.34 (2 s, CMe_2 β-anomer). Crystallization from methanol afforded the pure β-*anomer* **2** (1.83 g, 46%), m.p. 156–157 °C (Found: C, 66.5; H, 5.3. $C_{22}H_{22}O_7$ requires C, 66.3; H, 5.6%); $[\alpha]_D^{20}$ +191 (*c* 1.0, Me_2SO); λ_{max}(95% EtOH)/nm 280sh (ε 3600 dm^3 mol^{-1} cm^{-1}), 273 (4100) and 229 (24 800); λ_{min}/nm 255 (ε 3200).

9-(2-O-*Benzoyl*-3,4-O-*isopropylidene*-α-L-*arabinopyranosyl*)-*adenine* **3**.—This compound was prepared by treatment of adenine (1.32 g, 9.77 mol) with the sugar **2** (3.99 g, 10.0 mmol) and tin(IV) chloride (2.35 cm^3, 20.0 mmol) in anhydrous acetonitrile (200 cm^3) as described for other adenine nucleoside analogue series.[15,23] After the usual work-up, the residue was subjected to silica gel column chromatography, with a stepwise gradient of methanol (0–7%) in dichloromethane. Crystallization of the product in the appropriate fractions from dichloromethane afforded the *title compound* **3** (2.97 g, 74%), m.p. 226–227 °C (Found: C, 56.95; H, 5.1; N, 16.8. $C_{20}H_{21}N_5O_5 \cdot 1/5CH_2Cl_2$ requires C, 56.6; H, 5.0; N, 16.35%); $[\alpha]_D^{20}$ +13.0 (*c* 1.0, Me_2SO); λ_{max}(95% EtOH)/nm 258 (ε 16 200) and 233 (16 900); λ_{min}/nm 245 (ε 13 100) and 221 (12 600); δ_H 8.27 and 8.09 (1 H each, 2 s, 2- and 8-H), 7.7–7.4 (5 H, m, Ph), 7.13 (2 H, s, NH_2), 5.90 (1 H, d, $J_{1',2'}$ 9.6, 1′-H), 5.73 (1 H, dd, $J_{2',3'}$ 7.4, 2′-H), 4.63 (1 H, t, 3′-H), 4.5–4.3 (2 H, m, 4′- and 5′-H), 4.21 (1 H, dd, $J_{5',5''}$ 13.6, 5′-H′) and 1.59 and 1.33 (3 H each, 2 s, CMe_2); *m/z* (FAB > 0, NBA) 412 $(M + H)^+$, 277 $(s)^+$, 136 $(BH_2)^+$ and 105 $(C_6H_5CO)^+$.

9-(2-O-*Benzoyl*-3,4-O-*isopropylidene*-α-L-*arabinopyranosyl*)-2-N-*palmitoylguanine* **4**.—This compound was prepared by treatment of silylated 2-*N*-palmitoylguanine [obtained by reflux of 2-*N*-palmitoylguanine[28] (4.68 g, 12.0 mmol) with bis(trimethylsilyl)acetamide (BSA) (11.8 cm^3, 48.3 mmol) in anhydrous acetonitrile (50 cm^3) for 30 min] with the sugar **2** [3.99 g, 10.0 mmol; added in solution in acetonitrile (50 cm^3)] and TMSTf (2.73 cm^3, 15.1 mmol) as described for other guanine nucleoside analogue series.[23] After the usual work-up, the residue was subjected to silica gel column chromatography, with a stepwise gradient of methanol (0–3%) in dichloromethane. Crystallization of the product in the appropriate fractions from methanol afforded the *title compound* **4** (3.2 g, 48%), m.p. 199–200 °C (Found: C, 63.2; H, 7.3; N, 10.35. $C_{36}H_{51}N_5O_7 \cdot H_2O$ requires C, 63.2; H, 7.8; N, 10.2%); $[\alpha]_D^{20}$ +57.0 (*c* 1.0, in Me_2SO); λ_{max}(95% EtOH)/nm 281 (ε 13 000), 276 (13 000), 259 (16 100), 254 (16 200) and 234 (18 100); λ_{min}/nm 278 (ε 12 900), 270 (12 600), 256 (16 100) and 246 (14 600); δ_H 11.9 and 11.7 (1 H each 2 br s, 1-H and 2-NH), 8.12 (1 H, s, 8-H), 7.8–7.4 (5 H, m, Ph), 5.6 (2 H, m, 1′- and 2′-H), 4.59 (1 H, t, *J* 5.9, 3′-H), 4.4 (2 H, m, 4′- and 5′-H), 4.14 (1 H, dd, $J_{4',5''}$ 2.1, $J_{5',5''}$ 13.7, 5′-H″), 2.45 (2 H, t, $COCH_2$), 1.6–1.5 [5 H, m, CMe*Me* and $COCH_2CH_2$ (δ 1.58, s, CMe*Me*)], 1.34 (3 H, s, C*Me*Me), 1.21

(24 H, m, $[CH_2]_{12}$) and 0.83 (3 H, t, *J* 6.8, CH_2Me); *m/z* (FAB > 0, NBA) 666 $(M + H)^+$, 390 $(BH_2)^+$, 277 (s)$^+$, 152 $(BH_2 - CH_3[CH_2]_{14}CO + H)^+$ and 105 $(C_6H_5CO)^+$.

1-(2-O-*Benzoyl*-3,4-O-*isopropylidene*-α-L-*arabinopyranosyl*)-*thymine* **5** *and -uracil* **6**.—These compounds were prepared by treatment of thymine (1.26 g, 10.0 mmol) or uracil (1.12 g, 10.0 mmol) with the sugar **2** (3.99 g, 10.0 mmol), hexamethyldisilazane (HMDS) (1.67 cm^3, 8.0 mmol), chlorotrimethylsilane (TMSCl) (1.01 cm^3, 8.0 mmol) and tin(IV) chloride (1.41 cm^3, 12.0 mmol) as described for other thymine and uracil nucleoside analogue series.[15,16,23] After the usual work-up, the residues were directly crystallized to afford the *title compounds* **5** and **6**.

Compound **5** (2.82 g, 70%), m.p. 168–169 °C (from dichloromethane) (Found: C, 55.2; H, 5.2; N, 6.2. $C_{20}H_{22}N_2O_7 \cdot \frac{1}{2}CH_2Cl_2$ requires C, 55.3; H, 5.2; N, 6.3%); $[\alpha]_D^{20}$ +53.0 (*c* 1.0 in Me_2SO); λ_{max}(95% EtOH)/nm 262 (ε 9600) and 230 (14 800); λ_{min}/nm 248 (ε 8100); δ_H 11.3 (1 H, br s, 3-H), 7.9–7.5 (6 H; m, Ph and 6-H), 5.77 (1 H, d, $J_{1',2'}$ 9.6, 1′-H), 5.26 (1 H, dd, $J_{2',3'}$ 7.3, 2′-H), 4.60 (1 H, dd, $J_{3',4'}$ 5.7, 3′-H), 4.4-4.3 (2 H, m, 4′- and 5′-H), 4.13 (1 H, dd, $J_{4',5''}$ 2.3, $J_{5',5''}$ 13.7, 5′-H′), 1.77 (3 H, d, *J* 1.0, Me) and 1.55 and 1.31 (3 H each, 2 s, CMe_2); *m/z* (FAB > 0, NBA) 403 $(M + H)^+$.

Compound **6** (2.64 g, 68%), m.p. 176–177 °C (from diisopropyl ether) (Found: C, 58.4; H, 5.1; N, 6.3. $C_{19}H_{20}N_2O_7$ requires C, 58.8; H, 5.2; N, 7.2%); $[\alpha]_D^{20}$ +80.0 (*c* 1.0 in Me_2SO); λ_{max}(95% EtOH)/nm 260 (ε 10 100) and 232 (16 200); λ_{min}/nm 252 (ε 9700); δ_H 11.3 (1 H, br s, 3-H), 7.9–7.5 [6 H, m, Ph and 6-H (δ 7.63, d, $J_{5,6}$ 8.2, 6-H)], 5.78 (1 H, d, $J_{1',2'}$ 9.6, 1′-H), 5.64 (1 H, d, 5-H), 5.25 (1 H, dd, $J_{2',3'}$ 7.4, 2′-H), 4.60 (1 H, dd, $J_{3',4'}$ 5.6, 3′-H), 4.3 (2 H, m, 4′- and 5′-H), 4.14 (1 H, dd, $J_{4',5''}$ 2.1, $J_{5',5''}$ 13.7, 5′-H′) and 1.53 and 1.31 (3 H each, 2 s, CMe_2); *m/z* (FAB > 0, G–T) 389 $(M + H)^+$, 277 (s)$^+$, 113 $(BH_2)^+$ and 105 $(C_6H_5CO)^+$; *m/z* (FAB < 0, G–T) 479 $(M + G - H)^-$, 387 $(M - H)^-$ and 111 $(B)^-$.

4-N-*Benzoyl*-1-(2-O-*benzoyl*-3,4-O-*isopropylidene*-α-L-*arabinopyranosyl*)*cytosine* **7**.—A suspension of 4-*N*-benzoylcytosine[29] (2.48 g, 11.5 mmol) and ammonium sulfate (0.12 g, 0.9 mmol) in HMDS (62 cm^3, 297 mmol) was heated under reflux overnight. After cooling, the excess of HMDS was removed under reduced pressure and by co-distillation with anhydrous xylene.

The resulting silylated 4-*N*-benzoylcytosine was dissolved in anhydrous 1,2-dichloroethane (37 cm^3), then a solution of the sugar **2** (3.99 g, 10.0 mmol) in 1,2-dichloroethane (108 cm^3) and a solution of TMSTf (2.18 cm^3, 12.6 mmol) in the same solvent (15 cm^3) were added successively. The reaction mixture was heated under reflux for 1 h, cooled to room temperature, and then poured into ice-cold, saturated, aq. sodium hydrogen carbonate (160 cm^3). The organic layer was separated, washed with water (2 × 150 cm^3), dried over sodium sulfate, filtered, and evaporated to dryness under reduced pressure. Column chromatography of the residue on silica gel with stepwise gradient of methanol (0–2%) in dichloromethane afforded the *title compound* **7** (3.3 g, 67%), which was crystallized from methanol, m.p. 202–203 °C (Found: C, 63.5; H, 5.2; N, 8.7. $C_{26}H_{25}N_3O_7$ requires C, 63.5; H, 5.1; N, 8.55%); $[\alpha]_D^{20}$ +60.0 (*c* 1.0 in Me_2SO); λ_{max}(95% EtOH)/nm 302 (ε 9500), 260 (27 300) and 232 (22 400); λ_{min}/nm (ε 9000) and 244 (19 500); δ_H 11.1 (1 H, br s, 4-NH), 8.15 (1 H, d, $J_{5,6}$ 7.5, 6-H), 8.0–7.5 (10 H, m, 2 × Ph), 7.31 (1 H, d, 5-H), 5.99 (1 H, d, $J_{1',2'}$ 9.4, 1′-H), 5.30 (1 H, t, 2′-H), 4.63 (1 H, t, 3′-H), 4.3 (2 H, m, 4′- and 5′-H), 4.19 (1 H, d, $J_{5',5''}$ 13.5, 5′-H′) and 1.56 and 1.32 (3 H each, 2 s, CMe_2); *m/z* (FAB > 0, G–T) 492 $(M + H)^+$, 277 (s)$^+$, 216 $(BH_2)^+$ and 105 $(C_6H_5CO)^+$.

1-(2-O-*Benzoyl*-3,4-O-*isopropylidene*-α-L-*arabinopyranosyl*)-*cytosine* **8**.—To a solution of the nucleoside **7** (1.0 g, 2.04 mmol) in an acetic acid–pyridine mixture (1:4; 16 cm^3) was added hydrazine hydrate (0.49 cm^3, 10.08 mmol). The solution was stirred for 24 h at room temperature, and then evaporated to dryness under reduced pressure. Column chromatography of the residue on silica gel with stepwise gradient of methanol (0–5%) in dichloromethane afforded the *title compound* **8** (0.36 g, 46%), which was crystallized from ethyl acetate, m.p. 252–253 °C (Found: C, 58.9; H, 5.4; N, 10.9. $C_{19}H_{21}N_3O_6$ requires C, 58.9; H, 5.5; N, 10.9%); $[\alpha]_D^{20}$ +97.0 (*c* 1.0, Me_2SO); λ_{max}(95% EtOH)/nm 270 (ε 8900) and 231 (20 600); λ_{min}/nm 258 (ε 8700); δ_H 7.9–7.5 (6 H, m, Ph and 5-H), 7.2 and 7.1 (1 H each, 2 × br s, 4-NH_2), 5.87 (1 H, d, $J_{1',2'}$ 9.7, 1′-H), 5.72 (1 H, d, $J_{5,6}$ 7.6, 6-H), 5.23 (1 H, dd, $J_{2',3'}$ 7.5, 2′-H), 4.57 (1 H, dd, $J_{3',4'}$ 5.5, 3′-H), 4.3 (2 H, m, 4′- and 5′-H), 4.08 (1 H, dd, $J_{4',5''}$ 2.0, $J_{5',5''}$ 13.6, 5′-H′) and 1.53 and 1.30 (3 H each, 2 × s, CMe_2); *m/z* (FAB > 0, G–T) 775 $[2M + H]^+$, 388 $(M + H)^+$, 112 $(BH_2)^+$ and 105 $(C_6H_5CO)^+$; *m/z* (FAB < 0, G–T) 386 $(M - H)^-$ and 110 $(B)^-$.

General Procedure for the Preparation of 2′-O-*Benzoyl*-α-L-*arabinopyranosyl Nucleosides* **9–13**.—A suspension of the foregoing appropriate isopropylidene derivative (1.0 mmol) in an acetic acid–water mixture (7:3; 10 cm^3) was stirred and heated at 60 °C for 3 h. After cooling, the reaction mixture was evaporated to dryness under reduced pressure and the residue was co-evaporated under reduced pressure several times with ethanol to give a solid residue. The deisopropylidenated nucleosides **9–13** were purified by either silica gel column chromatography or direct crystallization.

9-(2-O-*Benzoyl*-α-L-*arabinopyranosyl*)*adenine* **9** (0.32 g, 86%, after direct crystallization from methanol), m.p. 237–238 °C (Found: C, 54.7; H, 4.7; N, 18.7. $C_{17}H_{17}N_5O_5$ requires C, 55.0; H, 4.6; N, 18.9%); $[\alpha]_D^{20}$ −39.2 (*c* 1.0, Me_2SO); λ_{max}(95% EtOH)/nm 258 (ε 15 600) and 232 (16 000); λ_{min}/nm 246 (ε 12 300) and 222 (12 300); δ_H 8.25 and 8.05 (1 H each, 2 s, 2- and 8-H), 7.7–7.4 (5 H, m, Ph), 7.16 (2 H, s, NH_2), 5.8–5.7 (2 H, m, 1′- and 2′-H), 5.29 (1 H, d, *J* 5.9, 3′-OH), 5.11 (1 H, d, *J* 5.5, 4′-OH), 4.0 (1 H, m, 3′-H) and 4.1–3.9 (3 H, m, 4′-H and 5′-H_2); *m/z* (FAB > 0, NBA) 372 $(M + H)^+$ and 136 $(BH_2)^+$.

9-(2-O-*Benzoyl*-α-L-*arabinopyranosyl*)-2-N-*palmitoylguanine* **10** (0.57 g, 91%, after direct crystallization from methanol), m.p. 204 °C (start of decomposition) (Found: C, 59.9; H, 7.4; N, 11.0. $C_{33}H_{47}N_5O_7 \cdot 2H_2O$ requires C, 59.9; H, 7.8; N, 10.6%); $[\alpha]_D^{20}$ +55.6 (*c* 1.0, Me_2SO); λ_{max}(95% EtOH)/nm 274 (ε 13 500), 256 (17 100), 254 (17 000) and 233 (15 600); λ_{min}/nm 270 (ε 13 400) and 243 (14 100); δ_H 12.1–11.5 (2 H, br s, 1-H and 2-NH), 8.09 (1 H, s, 8-H), 7.8–7.3 (5 H, m, Ph), 5.65 (1 H, t, *J* 9.3, 2′-H), 5.51 (1 H, d, 1′-H), 5.4 and 5.2 (1 H each, 2 br s, 3′- and 4′-OH), 4.0–3.8 (4 H, m, 3′- and 4′-H, and 5′-H_2), 2.42 (2 H, t, *J* 7.3, $COCH_2$), 1.6 (2 H, m, $COCH_2CH_2$), 1.3–1.2 (24 H, m, $[CH_2]_{12}$) and 0.83 (3 H, t, *J* 6.6, CH_2Me); *m/z* (FAB > 0, G) 626 $(M + H)^+$.

1-(2-O-*Benzoyl*-α-L-*arabinopyranosyl*)*thymine* **11** (0.33 g, 91%, after direct crystallization from a methanol–dichloromethane mixture), m.p. 223–224 °C (Found: C, 56.2; H, 5.1; N, 7.6. $C_{17}H_{18}N_2O_7$ requires C, 56.35; H, 5.0; N, 7.7%); $[\alpha]_D^{20}$ −13.0 (*c* 1.0 in Me_2SO); λ_{max}(95% EtOH)/nm 262 (ε 9900) and 229 (14 800); λ_{min}/nm 248 (ε 8100); δ_H 11.2 (1 H, br s, 3-H), 7.9–7.5 (6 H, m, Ph and 6-H), 5.68 (1 H, d, $J_{1',2'}$ 8.9, 1′-H), 5.35 (1 H, t, 2′-H), 5.3 and 5.1 (1 H each, 2 br s, 3′- and 4′-OH), 4.0 (1 H, m, 3′-H), 3.9–3.8 (3 H, m, 4′-H and 5′-H_2) and 1.78 (3 H, s, Me); *m/z* (FAB > 0, NBA) 363 $(M + H)^+$.

1-(2-O-*Benzoyl*-α-L-*arabinopyranosyl*)*uracil* **12** {0.30 g, 86%, after chromatography [eluent: stepwise gradient of methanol (0–10%) in dichloromethane], and then crystallization from diisopropyl ether}, m.p. 157–159 °C (Found: C, 52.2; H, 4.9; N, 7.35. $C_{16}H_{16}N_2O_7 \cdot H_2O$ requires C, 52.5; H, 4.95; N, 7.65%); $[\alpha]_D^{20}$ +28.4 (*c* 1.0 in Me_2SO); λ_{max}(95% EtOH)/nm 260 (ε 10 100) and 231 (14 900); λ_{min}/nm 247 (ε 8500); δ_H 11.2 (1 H, br s,

3-H), 7.9–7.5 [6 H, m, Ph and 6-H (δ 7.71, d, $J_{5,6}$ 8.2, 6-H)], 5.70 (2 H, m, 1′- and 5-H), 5.35 (1 H, t, J 9.4, 2′-H), 5.27 (1 H, d, J 6.0, 3′-OH), 5.08 (1 H, d, J 5.9, 4′-OH), 4.0 (1 H, m, 3′-H) and 3.9–3.8 (3 H, m, 4′-H and 5′-H_2); *m/z* (FAB > 0, G–T) 349 $(M + H)^+$, 237 (s)$^+$, 113 $(BH_2)^+$ and 105 $(C_6H_5CO)^+$; *m/z* (FAB < 0, G–T) 347 $(M - H)^-$ and 111 $(B)^-$.

1-(2-O-*Benzoyl*-α-L-*arabinopyranosyl*)*cytosine* **13** {0.29 g, 84%, after chromatography [eluent: stepwise gradient of methanol (0–15%) in dichloromethane], and then crystallization from methanol}, m.p. 179 °C (decomposition) (Found: C, 53.45; H, 5.1; N, 10.8. $C_{16}H_{17}N_3O_6{\cdot}CH_3OH$ requires C, 53.8; H, 5.6; N, 11.1%); $[\alpha]_D^{20}$ +23.8 (*c* 0.8 in Me_2SO); λ_{max}(95% EtOH)/nm 270 (ε 8600) and 232 (18 500); λ_{min}/nm 258 (ε 8100); δ_H 7.9–7.5 (6 H, m, Ph and 6-H), 7.2 and 7.0 (1 H each, 2 br s, NH_2), 5.79 (1 H, d, $J_{1',2'}$ 9.4, 1′-H), 5.72 (1 H, d, $J_{5,6}$ 7.5, 5-H), 5.33 (1 H, t, 2′-H), 5.22 (1 H, d, $J_{5,6}$, 3′-OH), 5.05 (1 H, d, J 5.6, 4′-OH), 3.9 (1 H, m, 3′-H) and 3.9–3.7 (3 H, m, 4′-H and 5′-H_2); *m/z* (FAB > 0, G–T) 348 $(M + H)^+$, 237 (s)$^+$ and 112 $(BH_2)^+$; *m/z* (FAB < 0, G–T) 454 $(M + T - H)^-$, 346 $(M - H)^-$ and 110 $(B)^-$.

General Procedure for the Preparation of 9- *and* 1-[(1R,2R)-2,3-*Dihydroxy*-1-(2-*hydroxyethoxy*)*propyl*]-*purines and* -*pyrimidines* **14–18**.—A solution of sodium metaperiodate (1.12 g, 5.24 mmol) in water (12.5 cm^3) was added to a solution of the foregoing appropriate deisopropylidenated derivative (3.5 mmol) in a 1,4-dioxane–water mixture (9:1, 35 cm^3). The reaction mixture was stirred overnight at room temperature, filtered, and the insoluble sodium iodate was washed with 1,4-dioxane. The combined filtrate and washings were concentrated to ~50 cm^3, and sodium borohydride (0.2 g, 5.29 mmol) was added in portions. The solution was stirred for 1 h at room temperature after the addition was complete, then was neutralized by careful addition of acetic acid, and evaporated to dryness under reduced pressure. The residue was dissolved in stirred methanolic ammonia (previously saturated at −10 °C and tightly stoppered; 90 cm^3) and stirred overnight at room temperature. The solution was then evaporated to dryness under reduced pressure and the residue was co-evaporated under reduced pressure with ethanol to give a crude compound. The title compounds were purified by chromatography, and then crystallized or lyophilized.

9-[(1R,2R)-2,3-*Dihydroxy*-1-(2-*hydroxyethoxy*)*propyl*]*adenine* **14** [0.25 g, 27%, after purification by HPLC (eluent: 3% acetonitrile in water; flow rate 6.75 cm^3/min), and then crystallization from water], m.p. > 260 °C (Found: C, 41.6; H, 5.6; N, 24.25. $C_{10}H_{15}N_5O_4{\cdot}H_2O$ requires C, 41.8; H, 6.0; N, 24.4%); $[\alpha]_D^{20}$ +9.6 (*c* 0.5, Me_2SO); λ_{max}(95% EtOH)/nm 258 (ε 14 500); λ_{min}/nm 226 (ε 1900); δ_H 8.23 and 8.13 (1 H each, 2 s, 2- and 8-H), 7.20 (2 H, s, NH_2), 5.63 (1 H, d, $J_{1',2'}$ 6.9, 1′-H), 5.2, 4.7 and 4.6 (1 H each, 3 br s, 2′-, 3′- and 5′-OH), 4.1 (1 H, m, 2′-H) and 3.5–3.2 (6 H, m, 3 × CH_2); *m/z* (FAB > 0, G–T) 270 $(M + H)^+$ and 136 $(BH_2)^+$.

9-[(1R,2R)-2,3-*Dihydroxy*-1-(2-*hydroxyethoxy*)*propyl*]*guanine* **15** [0.38 g, 38%, after purification by HPLC (eluent: 0.5% acetonitrile in water; flow rate 6.75 cm^3/min), and then repetitive crystallization from water], m.p. > 260 °C (Found: C, 37.5; H, 5.4; N, 21.4. $C_{10}H_{15}N_5O_5{\cdot}2H_2O$ requires C, 37.4; H, 5.95; N, 21.8%); $[\alpha]_D^{20}$ +10.0 (*c* 0.5, Me_2SO); λ_{max}(95% EtOH)/nm 270sh (ε 9400) and 253 (13 200); λ_{min}/nm 221 (ε 2800); δ_H 10.5 (1 H, br s, 1-H), 7.76 (1 H, s, 8-H), 6.43 (2 H, s, NH_2), 5.39 (1 H, d, $J_{1',2'}$ 7.0, 1′-H), 5.08 (1 H, d, J 5.5, 2′-OH), 4.6 (2 H, m, 3′- and 5′-OH), 4.0 (1 H, m, 2′-H) and 3.5–3.2 (6 H, m, 3 × CH_2 partially obscured by water).

1-[(1*R*,2*R*)-2,3-Dihydroxy-1-(2-hydroxyethoxy)propyl]thymine **16** {0.55 g, 60%, after purification by silica gel column chromatography [eluent: stepwise gradient of methanol (0–17%) in dichloromethane], and then lyophilization from water}, m.p. 148 °C (decomp.); $[\alpha]_D^{20}$ +57.0 (*c* 0.9, Me_2SO); λ_{max}(95% EtOH)/nm 266 (ε 9700); λ_{min}/nm 239 (ε 4000); δ_H 11.1 (1 H, br s, 3-H), 7.45 (1 H, s, 6-H), 5.54 (1 H, d, $J_{1',2'}$ 7.6, 1′-H), 4.99 (1 H, d, J 5.2, 2′-OH), 4.6 (2 H, m, 3′- and 5′-OH), 3.7 (1 H, m, 2′-H), 3.6–3.4 (6 H, m, 3 × CH_2) and 1.77 (3 H, s, Me); *m/z* (FAB > 0, G–T) 261 $(M + H)^+$ and 127 $(BH_2)^+$.

1-[(1R,2R)-2,3-*Dihydroxy*-1-(2-*hydroxyethoxy*)*propyl*]*uracil* **17** {0.55 g, 64%, after purification first by silica gel column chromatography [eluent: stepwise gradient of methanol (0–20%) in dichloromethane], then by silanized silica gel column chromatography [eluent: linear gradient of methanol (0–100%) in water], and finally lyophilization from water} (Found: C, 42.4; H, 6.0; N, 10.4. $C_9H_{14}N_2O_6{\cdot}\frac{1}{2}H_2O$ requires C, 42.35; H, 5.9; N, 11.0%); $[\alpha]_D^{20}$ +21.0 (*c* 1.6, Me_2SO); λ_{max}(95% EtOH)/nm 262 (ε 9100); λ_{min}/nm 230 (ε 1800); δ_H 11.2 (1 H, br s, 3-H), 7.58 (1 H, d, $J_{5,6}$ 8.0, 6-H), 5.59 (1 H, d, 5-H), 5.55 (1 H, d, $J_{1',2'}$ 7.2, 1′-H), 5.4–4.2 (3 H, br s, 2′-, 3′- and 5′-OH), 3.6 (1 H, m, 2′-H) and 3.6–3.3 (6 H, m, 3 × CH_2 partially obscured by water); *m/z* (FAB > 0, G–T) 339 $(M + G + H)^+$, 247 $(M + H)^+$ and 113 $(BH_2)^+$; *m/z* (FAB < 0, G–T) 337 $(M + G - H)^-$, 245 $(M - H)^-$ and 111 $(B)^-$.

1-[(1*R*,2*R*)-2,3-Dihydroxy-1-(2-hydroxyethoxy)propyl]cytosine **18** {0.38 g, 44%, after purification by silanized silica gel column chromatography [eluent: linear gradient of methanol (0–100%) in water], and then crystallization from water}, m.p. 198 °C (start of decomposition); $[\alpha]_D^{20}$ +13.3 (*c* 0.5, Me_2SO); λ_{max}(95% EtOH)/nm 271 (ε 9000) and 238 (8600); λ_{min}/nm 255 (ε 7500); δ_H 7.52 (1 H, d, $J_{5,6}$ 7.4, 6-H), 7.2–6.9 (2 H, br s, NH_2), 5.71 (1 H, d, 5-H), 5.67 (1 H, d, $J_{1',2'}$ 5.9, 1′-H), 5.1–4.5 (3 H, br s, 2′-, 3′- and 5′-OH), 3.7 (1 H, m, 2′-H) and 3.5–3.2 (6 H, m, 3 × CH_2 partially obscured by water); *m/z* (FAB > 0, G–T) 246 $(M + H)^+$, 133 (s)$^+$ and 112 $(BH_2)^+$.

General Procedure for the Preparation of α-L-*Arabinopyranosyl Nucleosides* **19–23**.—A solution of the foregoing appropriate 2′-*O*-benzoyl-α-L-arabinopyranosyl nucleoside (2.0 mmol) in methanolic ammonia (previously saturated at −10 °C and tightly stoppered; 50 cm^3) was stirred overnight at room temperature. The solution was evaporated to dryness under reduced pressure and the residue was co-evaporated under reduced pressure several times with methanol. The α-L-arabinopyranosylguanine **20** and the other title compounds were purified by either silanized silica gel column chromatography or by direct crystallization.

9-α-L-Arabinopyranosyladenine **19** (0.44 g, 82%, after direct crystallization from water) (Found: C, 42.7; H, 5.3; N, 23.6. Calc. for $C_{10}H_{13}N_5O_4{\cdot}H_2O$: C, 42.1; H, 5.3; N, 24.55%), m.p. 165–166 °C (lit.,[47] 269–270 °C and 235–236 °C; lit.,[48] 164–166 °C); $[\alpha]_D^{20}$ +35.5 (*c* 1.0, water) {lit.,[47] $[\alpha]_D^{25}$ +35.3 (*c* 1, water); lit.,[48] +35.9 (*c* 1.02, water)}; λ_{max}(95% EtOH)/nm 258 (ε 13 800); λ_{min}/nm 226 (ε 2400); δ_H 8.31 and 8.14 (1 each, 2 s, 2- and 8-H), 7.23 (2 H, s, NH_2), 5.30 (1 H, d, $J_{1',2'}$ 9.2, 1′-H), 5.19 (1 H, d, J 5.8, 2′-OH), 4.95 (1 H, d, J 5.6, 3′-OH), 4.71 (1 H, d, J 4.7, 4′-OH), 4.2 (1 H, m, 2′-H), 3.8–3.7 (3 H, m, 4′-H and 5′-H_2) and 3.6 (1 H, m, 3′-H); *m/z* (FAB > 0, G) 268 $(M + H)^+$ and 136 $(BH_2)^+$.

9-α-L-Arabinopyranosylguanine **20** {0.42 g, 74%, after chromatography [eluent: linear gradient of methanol (0–100%) in water], and then crystallization from water}, m.p. > 260 °C; $[\alpha]_D^{20}$ +36.7 (*c* 1.0, Me_2SO); λ_{max}(95% EtOH)/nm 270sh (ε 9200) and 253 (ε 13 100); λ_{min}/nm 225 (ε 5400); δ_H 10.6 (1 H, br s, 1-H), 7.75 (1 H, s, 8-H), 6.47 (2 H, s, NH_2), 5.2 (1 H, br s, OH), 5.03 (1 H, d, $J_{1',2'}$ 9.2, 1′-H), 5.0–4.8 (1 H, br s, OH), 4.7 (1 H, br s, OH), 4.02 (1 H, t well resolved after D_2O exchange, 2′-H), 3.8–3.7 (2 H, m, 4′- and 5′-H), 3.61 (1 H, d, $J_{5',5''}$ 12.2, 5′-H′) and 3.49 (1 H, dd well resolved after D_2O exchange, $J_{2',3'}$ 9.2, $J_{3',4'}$ 3.1, 3′-H); *m/z* (FAB > 0, NBA) 284 $(M + H)^+$.

1-α-L-Arabinopyranosylthymine **21** (0.46 g, 89%, after direct crystallization from ethanol) (Found: C, 46.3; H, 5.4; N, 10.7. Calc. for $C_{10}H_{14}N_2O_6$: C, 46.5; H, 5.5; N, 10.9%), m.p. 248–

249 °C (lit.,[49] 250–251 °C; lit.,[50] 248–250 °C; lit.,[51] 246–248 °C); $[\alpha]_D^{20}$ +89.0 (*c* 1.0, Me_2SO) and +66.0 (*c* 1.0, water) {lit.,[49] $[\alpha]_D^{25}$ +69 (*c* 3, water); lit.,[51] $[\alpha]_D^{20}$ +66.1 (*c* 1.34, water)}; λ_{max}(95% EtOH)/nm 262 (ε 9700); λ_{min}/nm 232 (ε 2400); δ_H 11.2 (1 H, br s, 3-H), 7.46 (1 H, d, *J* 0.8, 6-H), 5.22 (1 H, d, *J* 9.1, 1′-H), 5.17 (1 H, d, *J* 4.8, 2′-OH), 4.9 (1 H, br s, 3′-OH), 4.63 (1 H, d, *J* 5.0, 4′-OH), 3.8–3.7 (3 H, m, 2′-, 4′- and 5′-H), 3.61 (1 H, d, $J_{5',5''}$ 12.3, 5′-H′), 3.5 (1 H, dd well resolved after D_2O exchange, *J* 3.2, 9.2, 3′-H) and 1.79 (3 H, d, *J* 0.8, Me); *m/z* (FAB > 0, NBA) 259 $(M + H)^+$.

1-α-L-Arabinopyranosyluracil **22** (0.39 g, 80%, after direct crystallization from aq. ethanol) (Found: C, 43.4; H, 4.85; N, 11.05. Calc. for $C_9H_{12}N_2O_6 \cdot \frac{1}{4}H_2O$: C, 43.5; H, 5.1; N, 11.3%), m.p. 254–255 °C (lit.,[47] 254–255 °C; lit.,[52] 253–254 °C; lit.,[13] 251–253 °C); $[\alpha]_D^{20}$ +102.9 (*c* 1.0, Me_2SO) and +84.1 (*c* 1.1, water) {lit.,[47] $[\alpha]_D^{25}$ +86.4 (*c* 1, water); lit.,[13] +88 (*c* 0.5, water)}; λ_{max}(95% EtOH)/nm 259 (ε 10 100); λ_{min}/nm 226 (ε 1300); δ_H 11.2 (1 H, br s, 3-H), 7.58 (1 H, d, $J_{5,6}$ 8.1, 6-H), 5.65 (1 H, d, 5-H), 5.2 [2 H, m, 1′-H and 2′-OH; δ 5.20 (1 H, d, $J_{1',2'}$ 9.3, 1′-H) after D_2O exchange], 4.9 (1 H, br s, 4′-OH), 4.66 (1 H, d, *J* 5.0, 3′-OH), 3.8–3.6 (4 H, m, 2′-, 4′- and 5′-H) and 3.5 [1 H, m (dd well resolved after D_2O exchange, *J* 2.8, 9.1), 3′-H]; *m/z* (FAB > 0, G–T) 337 $(M + G + H)^+$, 245 $(M + H)^+$ and 113 $(BH_2)^+$; *m/z* (FAB < 0, G–T) 335 $(M + G - H)^-$, 243 $(M - H)^-$ and 111 $(B)^-$.

1-α-L-Arabinopyranosylcytosine **23** (0.43 g, 88%, after direct crystallization from ethanol) (Found: C, 44.2; H, 5.4; N, 17.0. Calc. for $C_9H_{13}N_3O_5$: C, 44.4; H, 5.4; N, 17.3%), m.p. >260 °C (lit.,[47] 266–267 °C); $[\alpha]_D^{20}$ +90.0 (*c* 1.0, Me_2SO) {lit.,[47] $[\alpha]_D^{25}$ +99.9 (*c* 1, water)}; λ_{max} (95% EtOH)/nm 270 (ε 9200) and 239 (7900); λ_{min}/nm 255 (ε 7500) and 225 (7700); δ_H 7.50 (1 H, d, $J_{5,6}$ 7.5, 6-H), 7.2–7.0 (2 H, br s, NH_2), 5.72 (1 H, d, 5-H), 5.35 (1 H, d, $J_{1',2'}$ 9.3, 1′-H), 4.99 (1 H, d, *J* 5.6, 2′- or 4′-OH), 4.83 (1 H, d, *J* 5.4, 3′-OH), 4.62 (1 H, d, *J* 4.9, 4′- or 2′-OH), 3.8–3.6 (3 H, m, 2′-, 4′- and 5′-H), 3.55 (1 H, d, $J_{5',5''}$ 12.1, 5′-H′) and 3.34 [1 H, m (dd well resoved after D_2O exchange, *J* 3.0, 9.2), 3′-H]; *m/z* (FAB > 0, G–T) 336 $(M + G + H)^+$, 244 $(M + H)^+$ and 112 $(BH_2)^+$; *m/z* (FAB < 0, G–T) 426 $(M + 2G - H)^-$, 334 $(M + G - H)^-$, 242 $(M - H)^-$ and 110 $(B)^-$.

General Procedure for the Preparation of 9- *and* 1-[(1R)-2-*Hydroxy*-1-(2-*hydroxyethoxy*)*ethyl*]-*purines and* -*pyrimidines* **24–28**.—A solution of sodium metaperiodate (0.45 g, 2.10 mmol) in water (5 cm^3) was added to a solution of the foregoing appropriate α-L-arabinopyranosylnucleoside (1.0 mmol) in a 1,4-dioxane–water mixture (9:1; 10 cm^3). The reaction mixture was stirred for 1 h at room temperature. Work-up, and reduction with sodium borohydride (0.08 g, 2.1 mmol), were performed as described previously for the synthesis of compounds **14–18**. The known adenine **24** and uracil **27** derivatives as well as the three other title compounds (new) were purified by chromatography.

9-[(1*R*)-2-Hydroxy-1-(2-hydroxyethoxy)ethyl]adenine **24** {0.16 g, 68%, after purification by silanized silica gel column chromatography [eluent: linear gradient of methanol (0–100%) in water], and then lyophilization from water} was obtained as very hygroscopic material in accord with previously reported data[14] (for racemic **24**: m.p. lit.,[11] 188–190 °C; lit.,[12] 150–151 °C); $[\alpha]_D^{20}$ +35.7 (*c* 1.0, water) {lit.,[14] $[\alpha]_D^{23}$ +34.5 (*c* 3.05, water)}; λ_{max}(95% EtOH)/nm 259 (ε 15 000); λ_{min}/nm 225 (ε 3800); δ_H 8.25 and 8.15 (1 H each, 2 s, 2- and 8-H), 7.21 (2 H, s, NH_2), 5.69 (1 H, t, *J* 5.8, 1′-H), 5.15 and 4.59 (1 H each, 2 t, *J* 5.9, 5.8, 2′- and 5′-OH), 3.9 (2 H, m, 2′-H_2) and 3.5–3.2 (4 H, m, 4′- and 5′-H_2), in accord with literature data for racemic **24**;[9,12] *m/z* (FAB > 0, G) 332 $(M + G + H)^+$, 240 $(M + H)^+$ and 136 $(BH_2)^+$.

9-[(1*R*)-2-Hydroxy-1-(2-hydroxyethoxy)ethyl]guanine **25** {0.13 g, 58%, after purification by silanized silica gel column chromatography [eluent: linear gradient of methanol (0–100%) in water], and then crystallization from water}, m.p. >260 °C (lit.,[10] >300 °C for racemic **25**); $[\alpha]_D^{20}$ +1.7 (*c* 1.2, Me_2SO); λ_{max}(95% EtOH)/nm 270sh (ε 9200) and 253 (13 200); λ_{min}/nm 223 (ε 4200); δ_H 11.0 (1 H, br s, 1-H), 7.75 (1 H, s, 8-H), 6.60 (2 H, s, NH_2), 5.43 (1 H, t, *J* 5.8, 1′-H), 5.1 and 4.6 (1 H, each, 2 br s, 2′- and 5′-OH), 3.79 (2 H, d, 2′-H_2) and 3.5–3.2 (4 H, m, 4′- and 5′-H_2), in accord with literature data for racemic **25**;[10] *m/z* (FAB > 0, G–T) 256 $(M + H)^+$ and 152 $(BH_2)^+$.

1-[(1*R*)-2-Hydroxy-1-(2-hydroxyethoxy)ethyl]thymine **26** {0.15 g, 67%, after purification by silica gel column chromatography [eluent: stepwise gradient of methanol (0–12%) in dichloromethane], and then lyophilization from water}, m.p. 171 °C (decomp.); $[\alpha]_D^{20}$ +57.3 (*c* 1.0, Me_2SO); λ_{max}(95% EtOH)/nm 266 (ε 9700); λ_{min}/nm 234 (ε 2800); δ_H 11.2 (1 H, br s, 3-H), 7.49 (1 H, d, *J* 1.0, 6-H), 5.58 (1 H, t, *J* 5.7, 1′-H), 5.0 and 4.6 (1 H each, 2 br s, 2′- and 5′-OH), 3.6–3.4 (6 H, m, 2′-, 4′- and 5′-H_2) and 1.77 (3 H, d, *J* 1.0, Me), in accord with literature data for racemic **26**;[12] *m/z* (FAB > 0, G–T) 323 $(M + G + H)^+$, 231 $(M + H)^+$ and 127 $(BH_2)^+$.

1-[-1*R*)-2-Hydroxy-1-(2-hydroxyethoxy)ethyl]uracil **27**[12] {0.13 g, 61%, after purification by silanized silica gel column chromatography [eluent: linear gradient of methanol (0–100%) in water], and then lyophilization from water} (Found: C, 42.9; H, 5.45; N, 12.2. Calc. for $C_8H_{12}N_2O_5 \cdot \frac{1}{2}H_2O$: C, 42.7; H, 5.8; N, 12.4%); m.p. 133–134 °C; $[\alpha]_D^{20}$ +58.3 (*c* 1.0, Me_2SO); λ_{max}(95% EtOH)/nm 262 (ε 10 100); λ_{min}/nm 230 (ε 1300); δ_H 11.2 (1 H, br s, 3-H), 7.56 (1 H, d, $J_{5,6}$ 7.9, 6-H), 5.60 (1 H, d, 5-H), 5.58 (1 H, t, *J* 5.4, 1′-H), 5.1 and 4.7 (1 H each, 2 br s, 2′- and 5′-OH) and 3.6–3.4 (6 H, m, 2′-, 4′- and 5′-H_2), in accord with literature data for racemic **27**;[12] *m/z* (FAB > 0, G–T) 433 $(2 M + H)^+$, 309 $(M + G + H)^+$, 217 $(M + H)^+$ and 113 $(BH_2)^+$; *m/z* (FAB < 0, G–T) 431 $(2 M - H)^-$, 307 $(M + G - H)^-$, 215 $(M - H)^-$ and 111 $(B)^-$.

1-[(1*R*)-2-Hydroxy-1-(2-hydroxyethoxy)ethyl]cytosine **28** {0.14, 67%, after purification by silica gel column chromatography [eluent: stepwise gradient of methanol (0–25%) in dichloromethane], and then lyophilization from water} was obtained as hygroscopic material; $[\alpha]_D^{20}$ +50.7 (*c* 1.5, Me_2SO); λ_{max}(95% EtOH)/nm 272 (ε 9100) and 238 (7800); λ_{min}/nm 252 (ε 7300) and 230 (7700); δ_H 7.49 (1 H, d, $J_{5,6}$ 7.4, 6-H), 7.2–7.0 (2 H, br s, NH_2), 5.71 (1 H, d, 5-H), 5.64 (1 H, t, *J* 5.1, 1′-H), 5.0–4.0 (2 H, br s, 2′- and 5′-OH) and 3.6–3.3 (6 H, m, 2′-, 4′- and 5′-H_2), in accord with literature data for racemic **28**;[12] *m/z* (FAB > 0, G–T) 216 $(M + H)^+$ and 112 $(BH_2)^+$; *m/z* (FAB < 0, G–T) 214 $(M - H)^-$ and 110 $(B)^-$.

9-(3,4-O-*Isopropylidene*-α-L-*arabinopyranosyl*)*adenine* **29**.—A solution of 9-(2-*O*-benzoyl-3,4-*O*-isopropylidene-α-L-arabinopyranosyl)adenine **3** (0.41 g, 1.0 mmol) in methanolic ammonia (previously saturated at −10 °C and tightly stoppered; 25 cm^3) was stirred overnight at room temperature. The solution was evaporated to dryness under reduced pressure and the residue was co-evaporated under reduced pressure several times with methanol. Crystallization of the product from methanol afforded the *title compound* **29** (0.29 g, 95%), m.p. >260 °C (Found: C, 50.7; H, 5.7; N, 22.7. $C_{13}H_{17}N_5O_4$ requires C, 50.8; H, 5.6; N, 22.8%); $[\alpha]_D^{20}$ +86.3 (*c* 1.0, Me_2SO); λ_{max} (95% EtOH)/nm 258 (ε 14 500); λ_{min}/nm 226 (ε 2800); δ_H 8.32 and 8.14 (1 H each, 2 s, 2- and 8-H), 7.21 (2 H, s, NH_2), 5.6 (1 H, br s, 2′-OH), 5.35 (1 H, d, $J_{1',2'}$ 9.5, 1′-H), 4.3–4.1 (4 H, m, 2′-, 3′-, 4′- and 5′-H), 4.01 (1 H, dd, $J_{4',5'}$ 2.6, $J_{5',5''}$ 13.5, 5′-H′) and 1.54 and 1.33 (3 H, each, 2 s, CMe_2); *m/z* (FAB > 0, G) 400 $(M + G + H)^+$, 308 $(M + H)^+$ and 136 $(BH_2)^+$.

9-(3,4-O-*Isopropylidene*-α-L-*arabinopyranosyl*)-2-N-*palmitoylguanine* **30**.—To a stirred, ice-cooled solution of 9-(2-*O*-benzoyl-3,4-*O*-isopropylidene-α-L-arabinopyranosyl)-2-*N*-

palmitoylguanine **4** (0.67 g, 1.0 mmol) in a pyridine–ethanol mixture (7:3; 17 cm^3) was added aq. 2 mol dm^{-3} sodium hydroxide (5 cm^3). The reaction mixture was stirred at 0 °C for 2 h, neutralized with acetic acid (*d* 1.05; 0.57 cm^3), and then diluted with dichloromethane (50 cm^3). The organic layer was washed with water (3 × 20 cm^3), dried over sodium sulfate, filtered, and evaporated to dryness. Crystallization of the product from methanol afforded the *title compound* **30** (0.46 g, 81%), m.p. 186 °C (Found: C, 59.9; H, 8.4; N, 11.9. $C_{29}H_{47}N_5O_6 \cdot H_2O$ requires C, 60.1; H, 8.5; N, 12.1%); $[\alpha]_D^{20}$ +44.1 (*c* 0.9, Me_2SO); λ_{max}(95% EtOH)/nm 280 (ε 12 700), 259 (16 700) and 254 (16 800); λ_{min}/nm 271 (ε 12 000), 257 (16 600) and 229 (5700); δ_H 12.1 and 11.6 (1 H each, 2 br s, 1-H and 2-NH), 8.17 (1 H, s, 8-H), 5.65 (1 H, d, *J* 5.7, 2′-OH), 5.15 (1 H, d, $J_{1',2'}$ 9.5, 1′-H), 4.29 (1 H, m, 4′-H), 4.22 (1 H, d, $J_{5',5''}$ 13.6, 5′-H), 4.13 (1 H, m, 3′-H), 4.06 (1 H, m, 2′-H), 3.91 (1 H, dd, $J_{4',5''}$ 2.5, 5′-H′), 2.44 (2 H, t, *J* 7.4, $COCH_2$), 1.6–1.5 [5 H, m, CMe*Me* and $COCH_2CH_2$ (δ 1.53, s, CMe*Me*)], 1.32 (3 H, s, C*Me*Me), 1.2 (24 H, m, $[CH_2]_{12}$) and 0.83 (3 H, t, *J* 6.6, CH_2Me); *m/z* (FAB > 0, NBA) 562 $(M + H)^+$, 390 $(BH_2)^+$ and 152 $(BH_2 - CH_3[CH_2]_{14}CO + H)^+$.

9-[3,4-O-*Isopropylidene*-2-O-*methoxy*(*thiocarbonyl*)-α-L-*arabinopyranosyl*]*adenine* **31**.—To a solution of 9-(3,4-*O*-isopropylidene-α-L-arabinopyranosyl)adenine **29** (3.1 g, 10.1 mmol) in DMF (80 cm^3) was added *N*,*N*′-thiocarbonyldiimidazole (2.67 g, 15.0 mmol), and the reaction mixture was heated and stirred at 80 °C for 3 h under argon. The solvent was removed under reduced pressure and the residue was dissolved in anhydrous methanol (80 cm^3); the solution was heated and stirred at 60 °C for 2 h, then evaporated to dryness. Crystallization of the product from methanol afforded the *title compound* **31** (2.2 g, 58%), m.p. 166–167 °C (Found: C, 47.2; H, 5.0; N, 18.2; S, 8.2. $C_{15}H_{19}N_5O_5S$ requires C, 47.2; H, 5.0; N, 18.4; S, 8.4%); $[\alpha]_D^{20}$ +84.6 (*c* 0.5, Me_2SO); λ_{max}(95% EtOH)/nm 259 (ε 15 500) and 238sh (9900); λ_{min}/nm 224 (ε 7300); δ_H 8.23 and 8.15 (1 H, each, 2 s, 2- and 8-H), 7.27 (2 H, s, NH_2), 6.00 (1 H, dd, *J* 7.3, 9.4, 2′-H), 5.85 (1 H, d, $J_{1',2'}$ 9.4, 1′-H), 4.6 (1 H, m, 3′-H), 4.4–4.3 (2 H, m, 4′- and 5′-H), 4.18 (1 H, dd, $J_{4',5''}$ 2.5, $J_{5',5''}$ 13.7, 5′-H′), 3.78 (3 H, s, OMe) and 1.58 and 1.34 (3 H each, 2 s, CMe_2); *m/z* (FAB > 0, G) 474 $(M + G + H)^+$, 382 $(M + H)^+$, 247 (s)$^+$ and 136 $(BH_2)^+$.

9-(2-*Deoxy*-3,4-O-*isopropylidene*-α-L-erythro-*pentopyranosyl*)*adenine* **33**.—A solution of 9-[3,4-*O*-isopropylidene-2-*O*-methoxy(thiocarbonyl)-α-L-arabinopyranosyl]adenine **31** (2.0 g, 5.2 mmol), tributyltin hydride (15.2 cm^3, 57.3 mmol) and AIBN (136 mg, 0.83 mmol) in toluene (270 cm^3) was stirred at 80 °C for 2 h under argon. The solvent was evaporated off under reduced pressure and the residue was subjected to silica gel column chromatography, with a stepwise gradient of methanol (0–7%) in dichloromethane. Crystallization of the product in the appropriate fractions from methanol afforded the *title compound* **33** (1.41 g, 92%), m.p. 200–201 °C (Found: C, 51.6; H, 6.15; N, 22.8. $C_{13}H_{17}N_5O_3 \cdot \frac{2}{3}H_2O$ requires C, 51.5; H, 6.1; N, 23.1%); $[\alpha]_D^{20}$ +46.0 (*c* 1.0, Me_2SO); λ_{max}(95% EtOH)/nm 259 (ε 14 300); λ_{min}/nm 226 (ε 2100); δ_H 8.40 and 8.15 (1 H, each, 2 s, 2- and 8-H), 7.24 (2 H, s, NH_2), 5.71 (1 H, dd, *J* 2.9, 10.3, 1′-H), 4.5 (1 H, m, 3′-H), 4.1 (2 H, m, 4′- and 5′-H), 3.97 (1 H, dd, $J_{4',5''}$ 3.2, $J_{5',5''}$ 13.7, 5′-H′), 2.45 (1 H, m, 2′-H partially obscured by Me_2SO), 2.3 (1 H, m, 2′-H′) and 1.52 and 1.31 (3 H each, 2 s, CMe_2); *m/z* (FAB > 0, G) 384 $(M + G + H)^+$, 292 $(M + H)^+$ and 136 $(BH_2)^+$.

9-(2-*Deoxy*-3,4-O-*isopropylidene*-α-L-erythro-*pentopyranosyl*)-2-N-*palmitoylguanine* **34**.—To a solution of 9-(3,4-*O*-isopropylidene-α-L-arabinopyranosyl)-2-*N*-palmitoylguanine **30** (0.42 g, 0.75 mmol) in anhydrous acetonitrile (75 cm^3) were added *O*-phenyl chlorothiocarbonate (0.15 cm^3, 1.08 mmol) and DMAP (0.28 g, 2.29 mmol). The solution was stirred overnight at room temperature, and then the solvent was removed under reduced pressure. Ethyl acetate (50 cm^3) and water (50 cm^3) were added. The organic phase was separated and washed successively with ice-cold 10% aq. acetic acid saturated with sodium chloride, water, saturated aq. sodium hydrogen carbonate, and water (50 cm^3 each) before being dried over sodium sulfate, filtered and evaporated to dryness. The residue was dissolved in dry toluene, the solution was evaporated under reduced pressure, and this process was repeated three times to give crude thiocarbonate **32** which was directly dissolved in dry toluene (7.5 cm^3) and treated with tributyltin hydride (0.5 cm^3, 1.89 mmol) and AIBN (37 mg, 0.23 mmol) at 80 °C for 2 h under argon. The solvent was evaporated off under reduced pressure and the residue was subjected to silica gel column chromatography, with a stepwise gradient of methanol (0–2%) in dichloromethane. Crystallization of the product in the appropriate fractions from methanol afforded the *title compound* **34** (0.25 g, 61%), m.p. 149–150 °C (Found: C, 63.8; H, 8.4; N, 12.8. $C_{29}H_{47}N_5O_5$ requires C, 63.8; H, 8.7; N, 12.8%); $[\alpha]_D^{20}$ +22.7 (*c* 1.0 in Me_2SO); λ_{max}(95% EtOH)/nm 278 (ε 12 900), 259 (16 300) and 254sh (16 100); λ_{min}/nm 270 (ε 12 600) and 225 (3000); δ_H 12.0 and 11.7 (1 H each, 2 br s, 1-H and 2-NH), 8.26 (1 H, s, 8-H), 5.54 (1 H, dd, *J* 5.2, 7.7, 1′-H), 4.49 (1 H, m, 3′-H), 4.1 (2 H, m, 4′- and 5′-H), 3.86 (1 H, dd, $J_{4',5'}$ 2.9, $J_{5',5''}$ 13.3, 5′-H′), 2.44 (2 H, t, *J* 7.4, $COCH_2$), 2.3 (2 H, m, 2′-H_2), 1.6 (2 H, m, $COCH_2CH_2$), 1.50 and 1.31 (3 H each, 2 s, CMe_2), 1.2 (24 H, m, $[CH_2]_{12}$) and 0.84 (3 H, t, *J* 6.7, CH_2Me); *m/z* (FAB > 0, NBA) 568 $(M + Na)^+$, 546 $(M + H)^+$ and 390 $(BH_2)^+$.

9-(2-*Deoxy*-α-L-erythro-*pentopyranosyl*)*adenine* **35** *and* 9-(2-(*Deoxy*-α-L-erythro-*pentopyranosyl*)-2-N-*palmitoylguanine* **36**.—The foregoing appropriate isopropylidene derivatives **33** (0.29 g, 1.0 mmol) and **34** (0.54 g, 1.0 mmol) were de-isopropylidenated following the general procedure used for the preparation of compounds **9**–**13**. Direct crystallization afforded the title compounds **35** and **36**.

Compound **35** (0.23 g, 92% after crystallization from aq. ethanol (Found: C, 45.4; H, 5.3; N, 26.1. $C_{10}H_{13}N_5O_3 \cdot \frac{2}{3}H_2O$ requires C, 45.6; H, 5.5; N, 26.6%), m.p. 248 °C (for the D-enantiomer: lit.,[53] 232–235 °C; lit.,[54] 231–232 °C; lit.,[55] 266 °C; lit.,[37] 235 °C); $[\alpha]_D^{20}$ +13.6 (*c* 1.0, water) {for the D-enantiomer: lit.[53] $[\alpha]_D^{25}$ +6.0 (*c* 1.0, water); lit.,[54] −11.4 (*c* 0.7, water); lit.,[55] $[\alpha]_D^{25}$ −17; lit.,[37] $[\alpha]_D^{21}$ +5.66 (*c* 1.1, water)}; λ_{max}(95% EtOH)/nm 259 (ε 14 800); λ_{min}/nm 226 (ε 2500); δ_H 8.30 and 8.14 (1 H each, 2 s, 2- and 8-H), 7.22 (2 H, s, NH_2), 5.64 (1 H, dd, *J* 2.0, 11.1, 1′-H), 4.88 (1 H, d, *J* 5.1, OH), 4.62 (1 H, d, *J* 4.3, OH), 3.8 (2 H, m, 3′- and 4′-H), 3.7 (2 H, m, 5′-H_2), 2.5 (1 H, m, 2′-H partially obscured by Me_2SO) and 1.9 (1 H, m, 2′-H′), in close agreement with literature data for the D-enantiomer;[37] *m/z* (FAB > 0, G) 252 $(M + H)^+$ and 136 $(BH_2)^+$.

Compound **36** (0.44 g, 87% after crystallization from methanol) (Found: C, 60.7; H, 8.9; N, 13.7. $C_{26}H_{43}N_5O_5 \cdot \frac{1}{2}H_2O$ requires C, 60.7; H, 8.6, N, 13.6%), m.p. >250 °C; $[\alpha]_D^{20}$ +43.6 (*c* 1.0, Me_2SO); λ_{max}(95% EtOH)/nm 277sh (ε 12 700), 259 (16 100) and 254sh (16 000); λ_{min}/nm 228 (ε 3700); δ_H 12.0 (2 H, br s, 1-H and 2-NH), 8.15 (1 H, s, 8-H), 5.45 (1 H, m, 1′-H), 4.9 (1 H, br s, OH), 4.7 (1 H, br s, OH), 3.8 (2 H, m, 3′- and 4′-H), 3.6 (2 H, m, 5′-H_2), 2.4 (3 H, m, 2′-H and $COCH_2$ partially obscured by Me_2SO), 1.9 (1 H, m, 2′-H′), 1.6 (2 H, m, $COCH_2CH_2$), 1.2 (24 H, m, $[CH_2]_{12}$) and 0.84 (3 H, t, *J* 6.5, CH_2Me); *m/z* (FAB > 0, G–T) 506 $(M + H)^+$, 390 $(BH_2)^+$ and 152 $(BH_2 - CH_3[CH_2]_{14}CO + H)^+$.

9-(2-*Deoxy*-α-L-erythro-*pentopyranosyl*)*guanine* **37**.—A suspension of 9-(2-deoxy-α-L-*erythro*-pentopyranosyl)-2-*N*-palmi-

(previously saturated at −10 °C and tightly stoppered; 5 cm^3) was stirred overnight at room temperature, and then evaporated to dryness. The residue was purified by HPLC (eluent: 0.5% acetonitrile in water; flow rate 6.75 cm^3/min) to afford the title compound **37** (0.036 g, 67%), which was first lyophilized and then crystallized from water; m.p. 186 °C (decomp.); $[\alpha]_D^{20}$ +25.4 (*c* 0.6, Me_2SO); λ_{max}(95% EtOH)/nm 267sh (ε 11 000) and 254 (13 100); δ_H 10.6 (1 H, br s, 1-H), 7.83 (1 H, s, 8-H), 6.47 (2 H, s, NH_2), 5.35 (1 H, dd, *J* 2.0, 11.1, 1′-H), 4.9 (1 H, br s, OH), 4.6 (1 H, br s, OH), 3.8 (2 H, m, 3′- and 4′-H), 3.6 (2 H, m, 5′-H_2), 2.3 (1 H, m, 2′-H) and 1.9 (1 H, m, 2′-H′); *m/z* (FAB > 0, NBA) 268 $(M + H)^+$.

9-[(1R)-3-*Hydroxy*-1-(2-*hydroxyethoxy*)*propyl*]*adenine* **38**.—This compound was synthesized from 9-(2-deoxy-α-L-*erythro*-pentopyranosyl)adenine **35** (0.25 g, 1.0 mmol) following the general procedure used for the preparation of compounds **24**–**28**. After the usual work-up, the residue was subjected to silanized silica gel column chromatography, with a linear gradient of methanol (0–100%) in water. Lyophilization of the product in the appropriate fractions from water afforded the title compound **38** (0.12 g, 47%) (Found: C, 45.8; H, 5.9; N, 27.3. Calc. for $C_{10}H_{15}N_5O_3 \cdot \frac{1}{2}H_2O$: C, 45.8; H, 6.15; N, 26.7%) as a hygroscopic compound [lit.,[37] m.p. 138 °C (from water)]; $[\alpha]_D^{20}$ +17.0 (*c* 1.0, Me_2SO) {lit.,[53] $[\alpha]_D^{26}$ +10.2; lit.,[37] $[\alpha]_D^{20}$ +10.14 (*c* 0.7, water)}; λ_{max}(95% EtOH)/nm 259 (ε 14 200); λ_{min}/nm 226 (ε 5200); δ_H 8.29 and 8.14 (1 H each, 2 s, 2- and 8-H), 7.21 (2 H, s, NH_2), 5.86 (1 H, dd, *J* 6.2, 7.1, 1′-H), 4.6 (2 H, m, 2 × OH), 3.6–3.2 (6 H, m, 3 × CH_2 partially obscured by water), 2.4 (1 H, m, 2′-H), 2.2 (1 H, m, 2′-H′), more or less in accord with literature data for the (*R*) enantiomer[36,37] and for racemic **38**;[9,34] *m/z* (FAB > 0, G) 346 $(M + G + H)^+$, 254 $(M + H)^+$ and 136 $(BH_2)^+$.

9-[(1R)-3-*Hydroxy*-1-(2-*hydroxyethoxy*)*propyl*]*guanine* **39**.—This compound was synthesized from 9-(2-deoxy-α-L-*erythro*-pentopyranosyl)-2-*N*-palmitoylguanine **36** (0.51 g, 1.0 mmol) following the general procedure used for the preparation of compounds **14**–**18**. After the usual work-up, the residue was subjected to silanized silica gel column chromatography, with a linear gradient of methanol (0–100%) in water. Crystallization of the product in the appropriate fractions from water afforded the title compound **39** (0.11 g, 41%), m.p. >260 °C (for racemic **39**: lit.,[34] 305 °C; lit.,[35] >300 °C); $[\alpha]_D^{20}$ +8.3 (*c* 0.5, Me_2SO); λ_{max}(95% EtOH)/nm 268sh (ε 11 100) and 253 (13 200); δ_H 10.6 (1 H, br s, 1-H), 7.80 (1 H, s, 8-H), 6.45 (2 H, s, NH_2), 5.62 (1 H, t, *J* 6.7, 1′-H), 4.5 (2 H, br s, 2 × OH), 3.5–3.2 (6 H, m, 3 × CH_2 partially obscured by water), 2.3 (1 H, m, 2′-H), 2.0 (1 H, m, 2′-H′), in accord with literature data for the (*R*) enantiomer[36] and for racemic **39**;[34] *m/z* (FAB > 0, G–T) 270 $(M + H)^+$ and 152 $(BH_2)^+$; *m/z* (FAB < 0, G–T) 268 $(M - H)^-$ and 150 $(B)^-$.

Biological Methods.—The broad antiviral assays on cell culture and the anti-HIV assays were performed by following previously established procedures as described in refs. 22 and 23.

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